

# Trends in Antimicrobial Resistance: Animal NARMS

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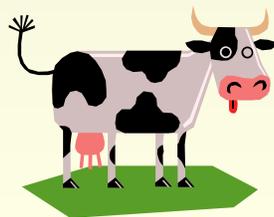
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USDA-ARS

Antimicrobial Resistance Research Unit  
Athens, GA

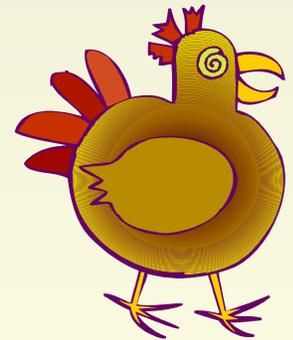


# Acknowledgements

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- ★ Dr. Jeanetta Tankson
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- ★ Takiyah Ball
- ★ Carolina Hall
- ★ Scott Ladely



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- ★ Benny Barrett
- ★ Jovita Hermosillo
- ★ Eric Adams
- ★ Sandra House
- ★ Jodie Plumblee
- ★ Rosie Minish
- ★ Lari Hiott
- ★ Tiffanie Woodley





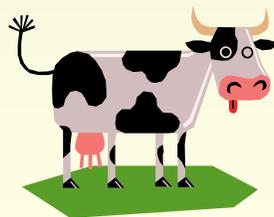
# Acknowledgements

## FDA

- ★ Dr. Marcia Headrick
- ★ Dr. Linda Tollefson

## USDA-FSIS

- ★ Dr. Ben Salamone
- ★ Dr. Neena Anandaraman
- ★ Bonnie Rose



## USDA-APHIS

- ★ Dr. Dave Dargatz
- ★ Dr. Nora Wineland

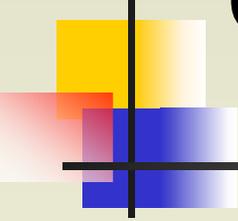
## CDC - Human NARMS

- ★ Dr. Fred Angulo

## Non-federal partners

- ★ State health depts
- ★ Veterinary diagnostic labs



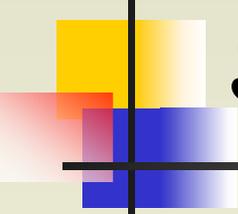


# Goals and Objectives

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- ★ To provide descriptive data on the extent and temporal trends of antimicrobial susceptibility in *Salmonella* and other zoonotic enteric organisms from human and animal populations
- ★ Identification of resistance as it arises
- ★ Timely information
- ★ Prolong the lifespan of approved drugs
- ★ Identify areas for more detailed investigation and guide research

# Bacterial Isolates and Sources



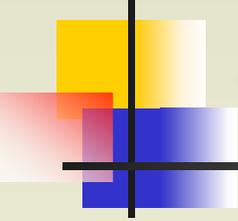
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## Animal

- ★ Non-Typhi *Salmonella*
- ★ Generic *E. coli*
  - ★ 0157:H7 when available
- ★ *Enterococci*
- ★ *Campylobacter*
  
- ★ *Listeria* [2004]

## Animal

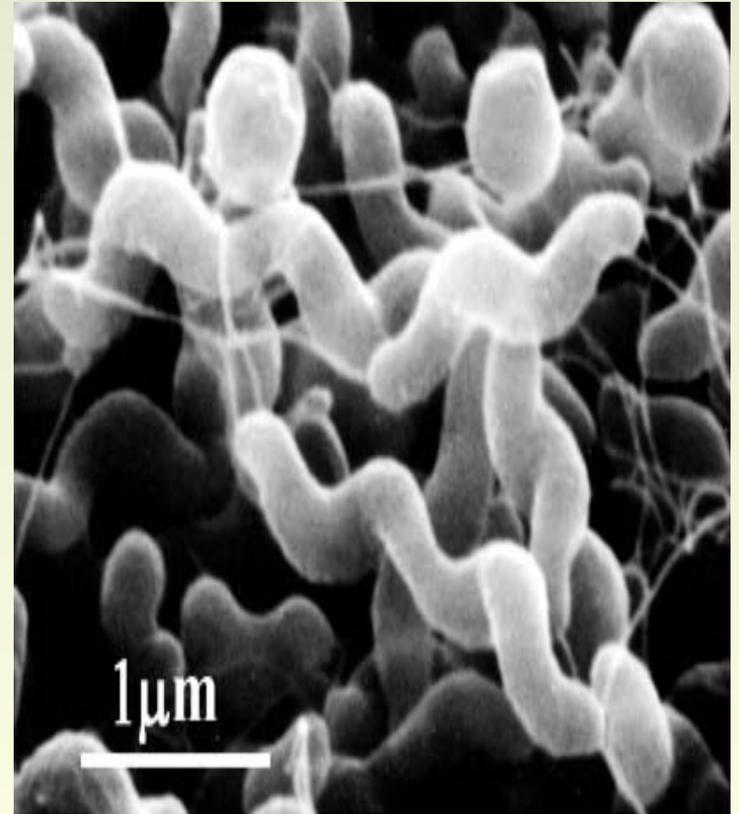
- ★ Diagnostic; *Salmonella*, *E. coli*
  - ★ NVSL, Vet Diagnostic Labs (Sentinel Sites)
- ★ Non-diagnostic; *E. coli*, *Salmonella*, *Campy*, *Enterococci*
  - ★ Raw product from federally inspected slaughter and processing plants
  - ★ Focused studies



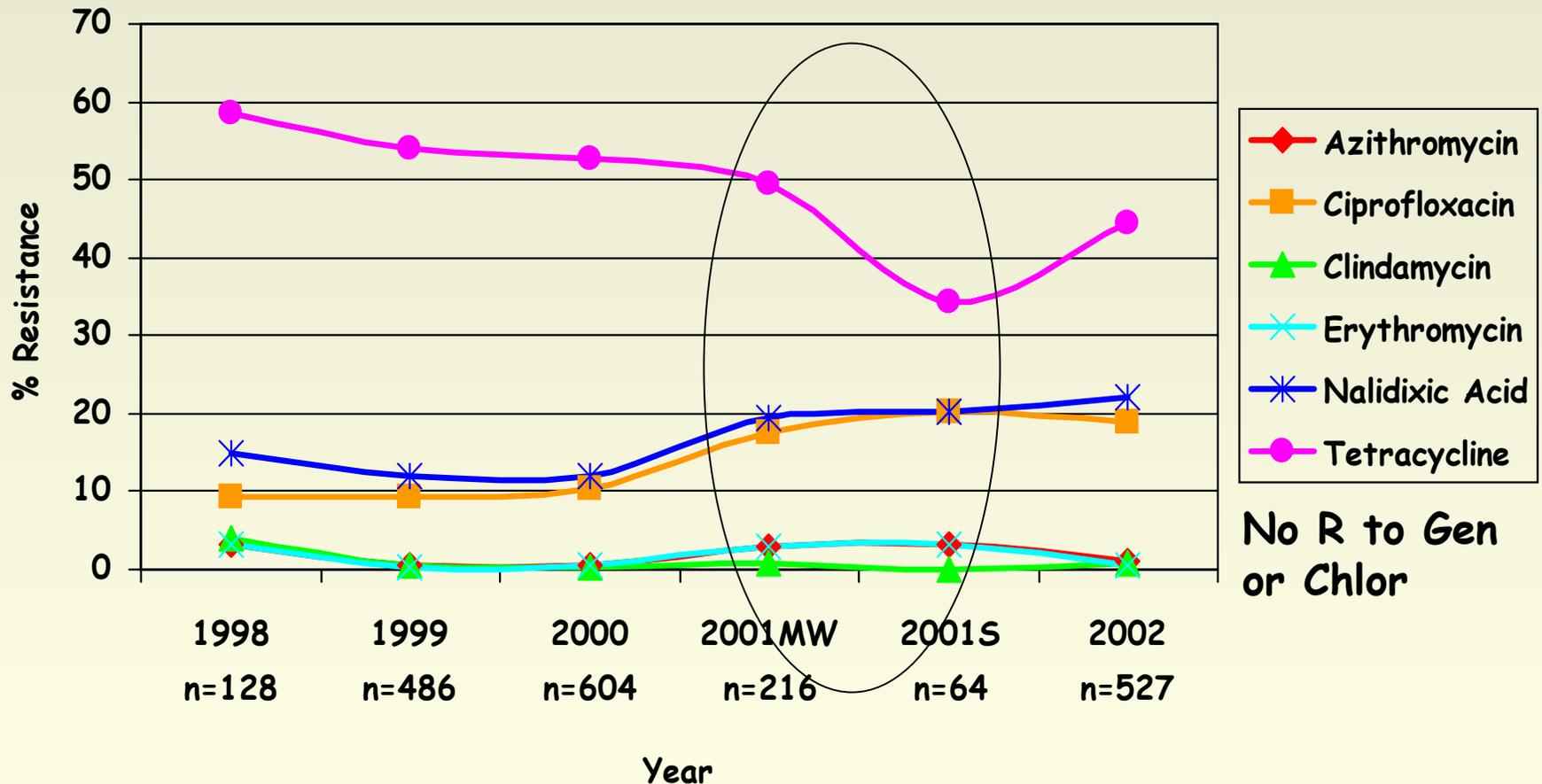
# *Campylobacter*

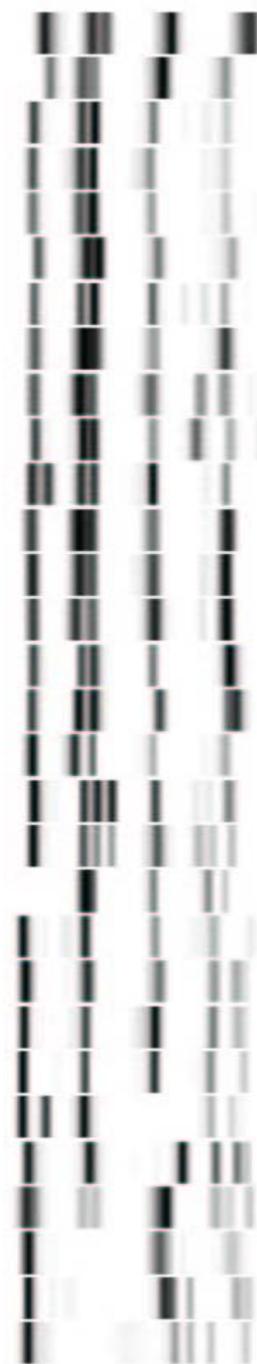
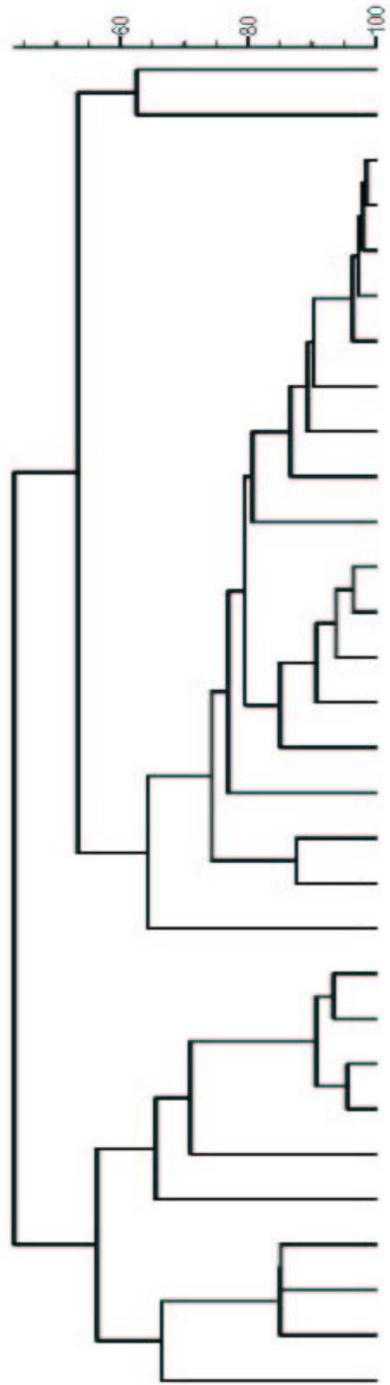
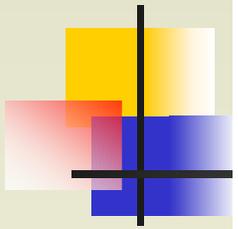
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- ★ Added in 1998
- ★ 1998 through 2000  
Campy obtained by  
FSIS methods
  - ★ NA used in screening
  - ★ Underestimated % R to  
Quinolones, FQs
- ★ 2001 method changed
  - ★ More accurate reflection  
of resistance in the total  
population



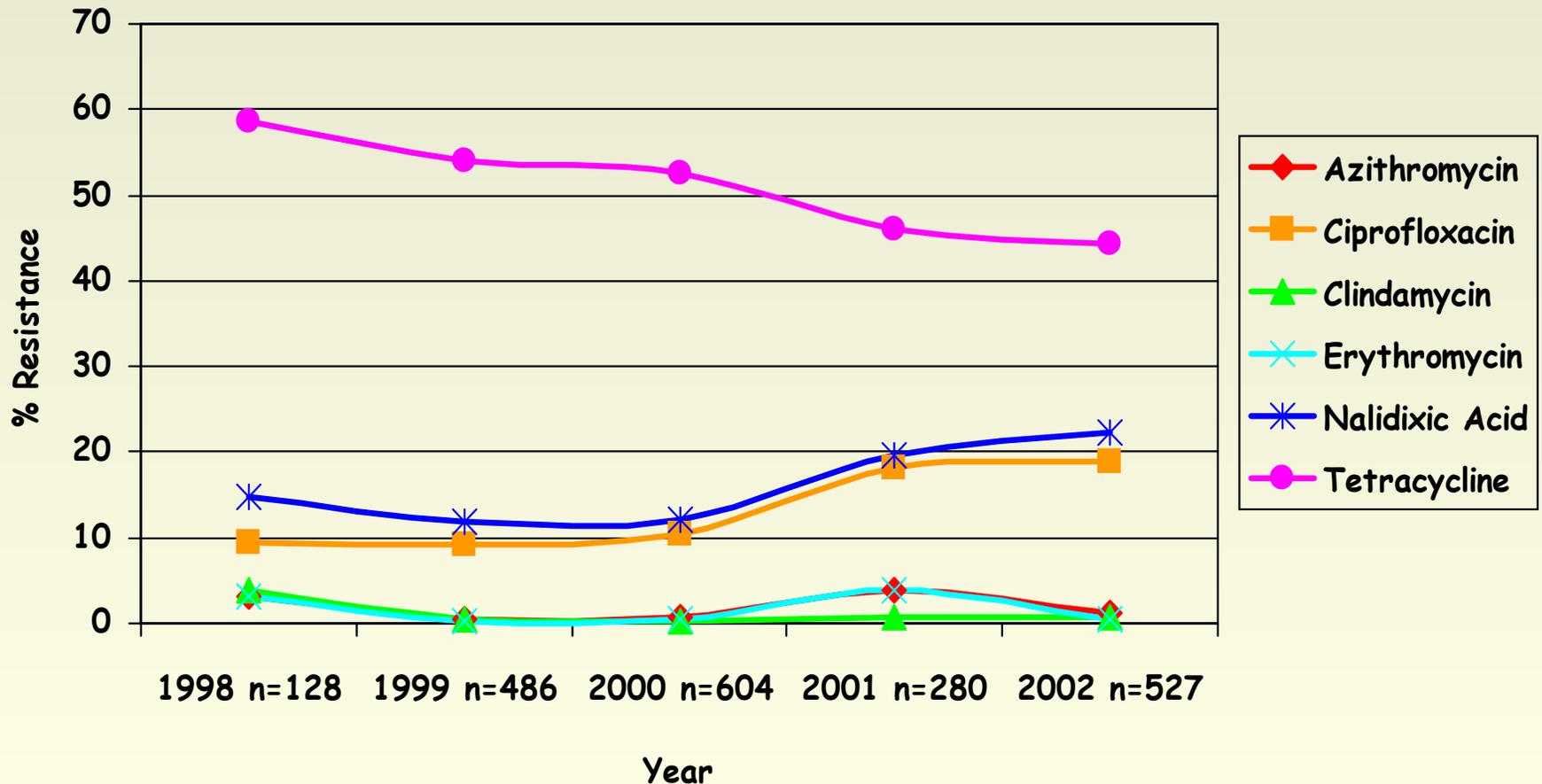
# *Campylobacter jejuni* 1998-2002





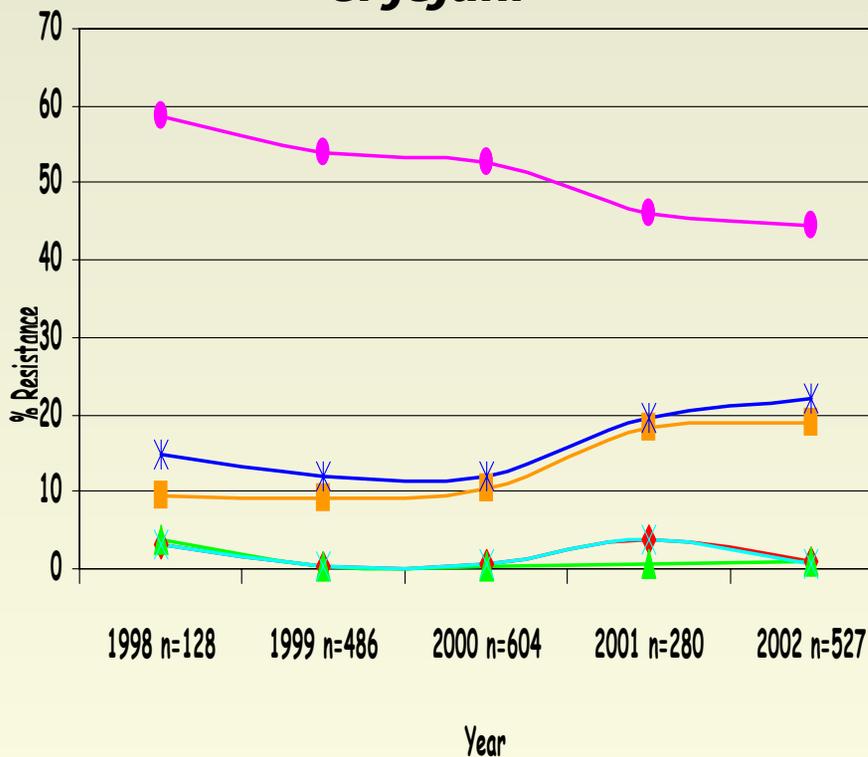
79886-se	<i>C. coli</i>	
83528-me	<i>C. jejuni</i>	Tc
83316-me	<i>C. coli</i>	Tc
87377-me	<i>C. coli</i>	Tc
82491-se	<i>C. coli</i>	Tc
82236-se	<i>C. coli</i>	Tc
82491-me	<i>C. coli</i>	Tc
80147-se	<i>C. coli</i>	Ci, Na
78006-me	<i>C. coli</i>	Tc
84123-me	<i>C. coli</i>	Ci, Na, Tc
83316-se	<i>C. coli</i>	Tc
81566-se	<i>C. coli</i>	Az, Em, Tc
81566-me	<i>C. coli</i>	Az, Em, Tc
87511-se	<i>C. coli</i>	
80147-me	<i>C. coli</i>	Ci, Na
79886-me	<i>C. coli</i>	
87377-se	<i>C. coli</i>	Na
80780-se	<i>C. coli</i>	Tc
80780-me	<i>C. coli</i>	Tc
83322-se	<i>C. coli</i>	Az, Em, Tc
83777-me	<i>C. jejuni</i>	Ci, Na, Tc
78006-se	<i>C. jejuni</i>	
87511-me	<i>C. jejuni</i>	
83777-se	<i>C. jejuni</i>	Ci, Na, Tc
84123-se	<i>C. jejuni</i>	
82236-me	<i>C. coli</i>	Tc
83322-me	<i>C. coli</i>	
87376-me	<i>C. jejuni</i>	
87376-se	<i>C. jejuni</i>	
83528-se	<i>C. jejuni</i>	

# *Campylobacter jejuni* 1998-2002

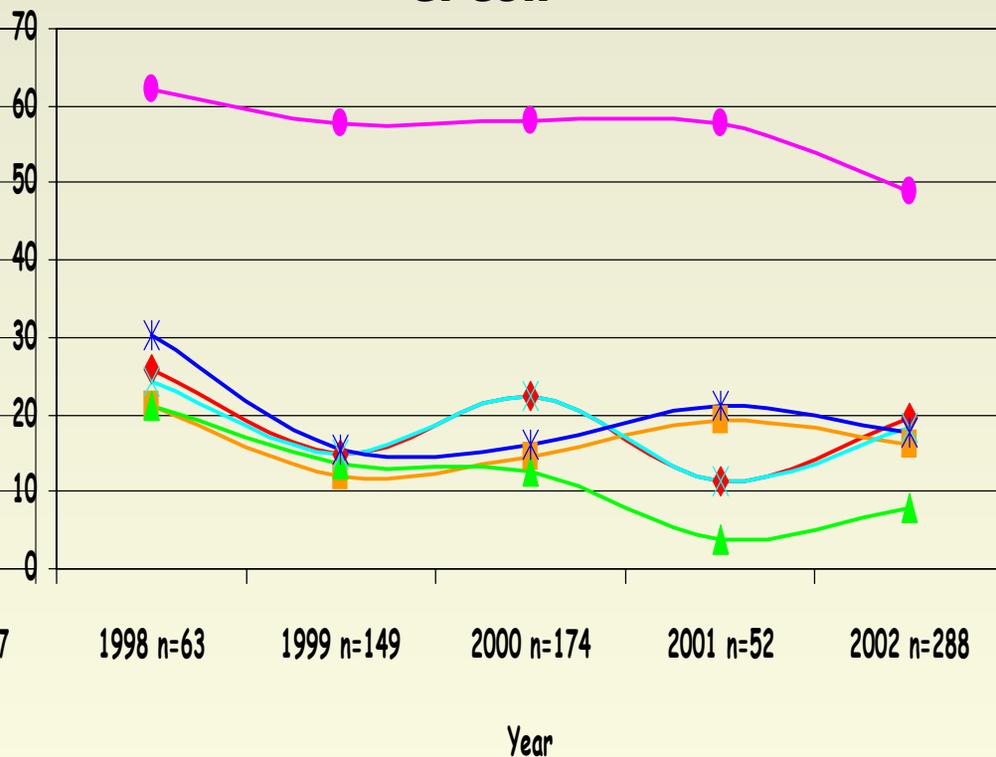


# *C. jejuni* and *C. coli* 1998-2002

*C. jejuni*

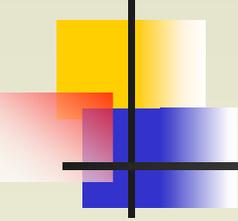


*C. coli*



◆ Azithromycin   
 ■ Ciprofloxacin   
 ▲ Clindamycin   
 ✱ Erythromycin  
✱ Nalidixic Acid   
 ● Tetracycline

◆ Azithromycin   
 ■ Ciprofloxacin   
 ▲ Clindamycin   
 ✱ Erythromycin  
✱ Nalidixic Acid   
 ● Tetracycline



# Most Frequent R Patterns

## *C. jejuni* 1998-2001

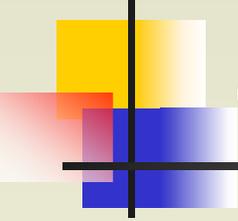
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R Profile	1998 n=128 (%)	1999 n=486 (%)	2000 n=604 (%)	2001 n=280 (%)
Pan S	44 (34.4)	197 (40.5)	246 (40.7)	125 (44.6)
Tc	58 (45.3)	220 (45.3)	277 (45.9)	90 (32.1)
Ci, Na, Tc	8 (6.3)	30 (6.2)	39 (6.5)	34 (12.1)
Na, Tc	6 (4.7)	7 (1.4)	7 (1.2)	4 (1.4)
Ci, Na	-	15 (3.1)	23 (3.8)	17 (6.1)
Az, Cm, Em	-	-	-	4 (1.4)

# Most Frequent R Patterns *C. coli* 1998-2001

1998 n=63 (%)		1999 n=149 (%)	
Pan S	12 (19.0)	Pan S	50 (34.0)
Tc	17 (27.0)	Tc	57 (38.0)
Ci, Na, Tc	10 (15.9)	Az, Cm, Em, Tc	12 (8.1)
Az, Cm, Em, Tc	8 (12.7)	Ci, Na	7 (4.7)
		Ci, Na, Tc	5 (3.4)

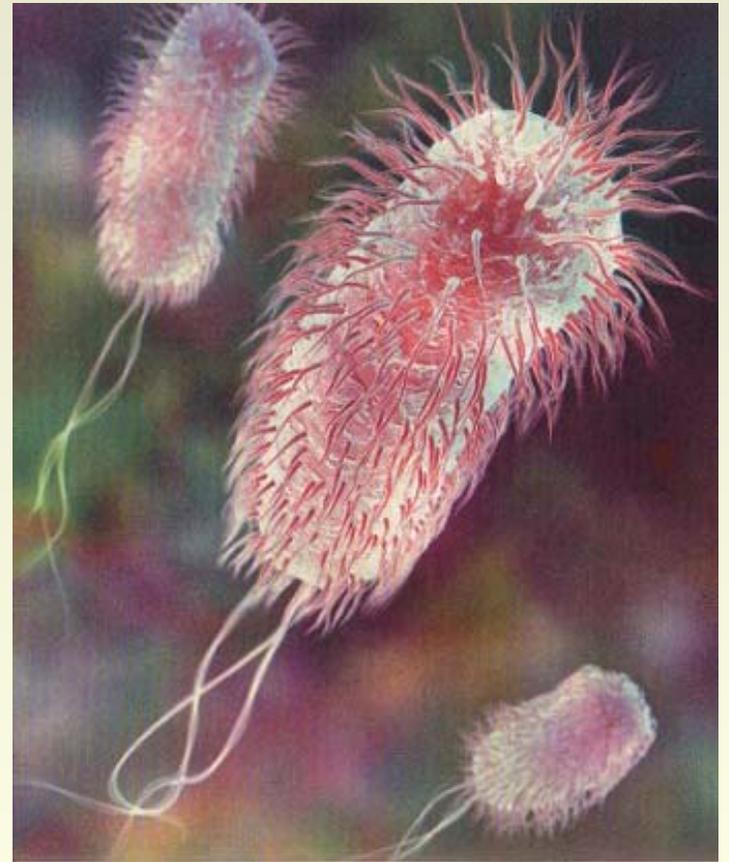
2000 n=174 (%)		2001 n=190 (%)	
Pan S	47 (27.0)	Pan S	56 (29.5)
Tc	65 (37.4)	Tc	51 (26.8)
Az, Cm, Em, Tc	14 (8.0)	Ci, Na, Tc	28 (14.7)
Ci, Na, Tc	13 (7.5)	Az, Em, Tc	10 (5.3)
Az, Cm, Em	7 (4.0)	Ci, Na	9 (4.7)



# *E. coli*

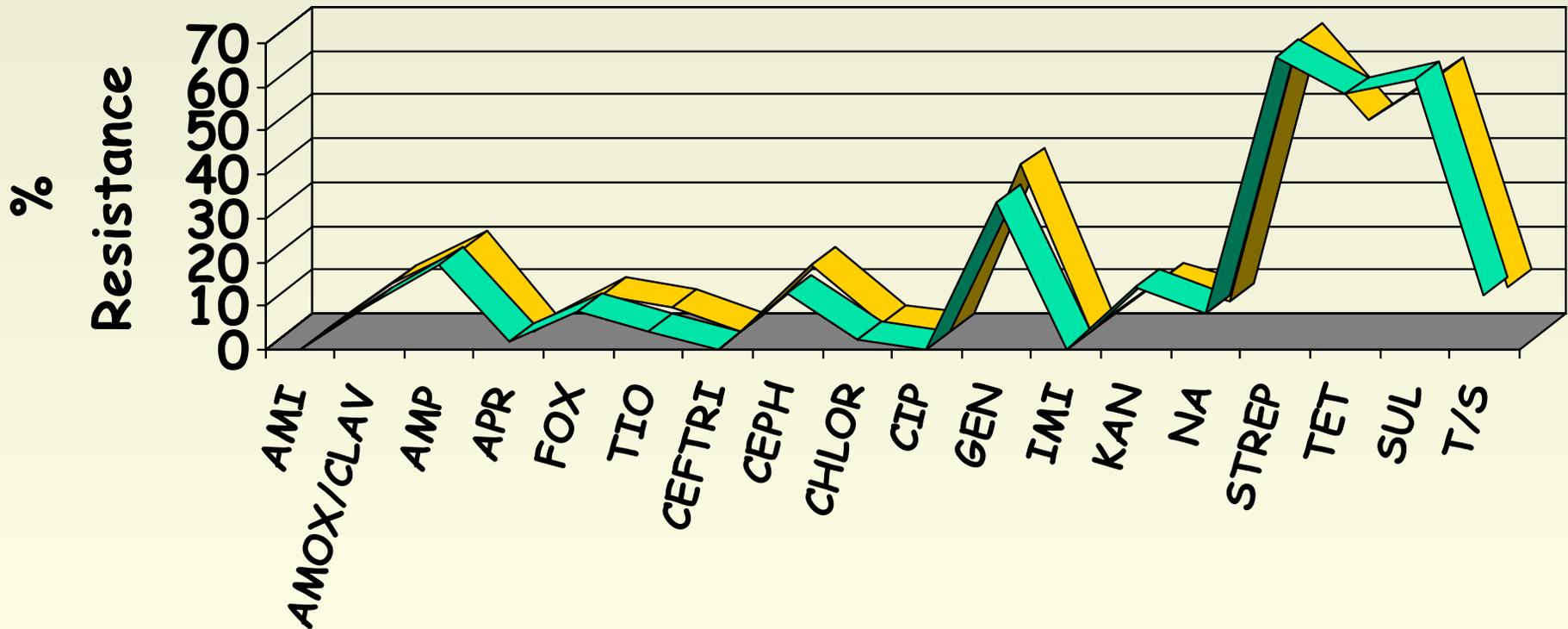
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- ★ *Generic E. coli*
- ★ Started in 2001
- ★ The majority of samples originate from poultry rinsates



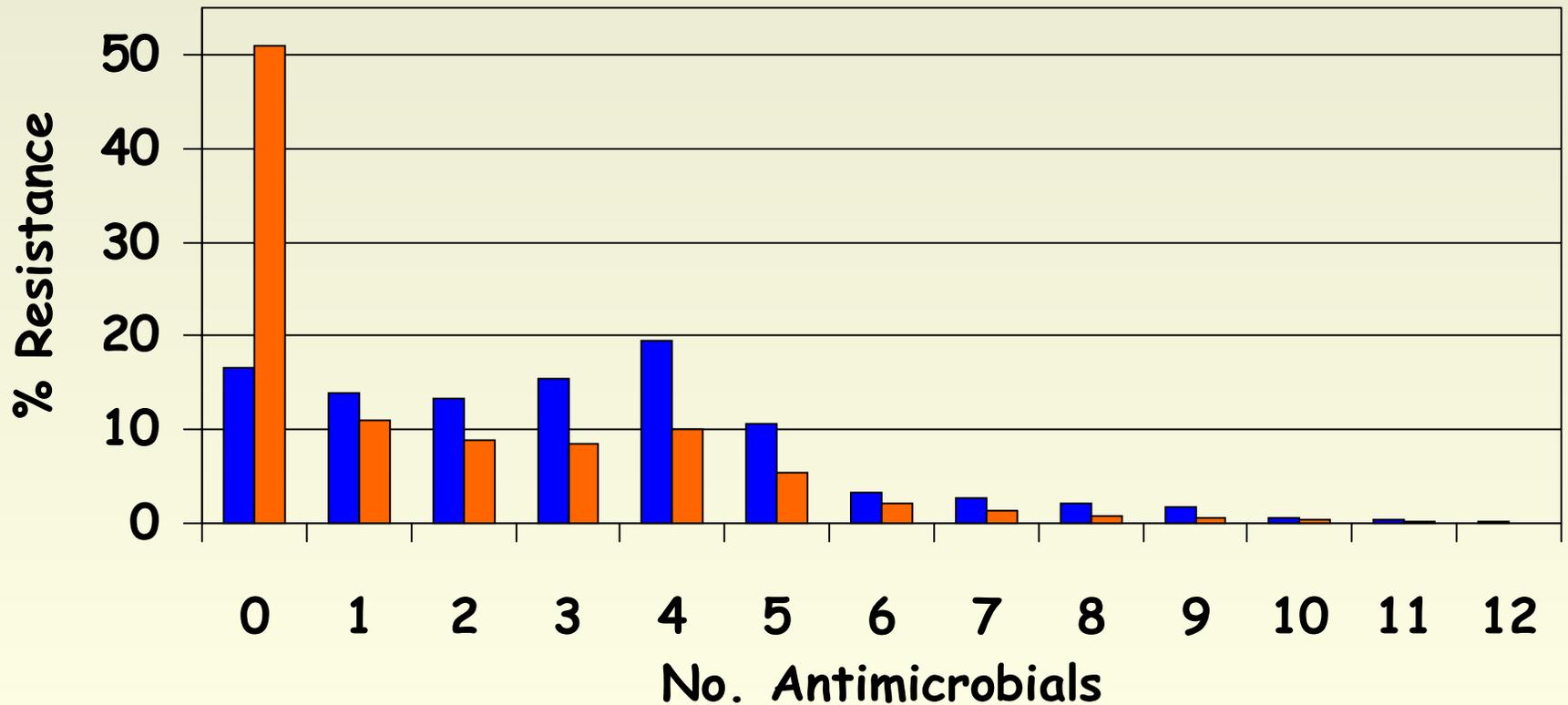
# *E. coli* Chicken Slaughter Resistance 2001 - 2002

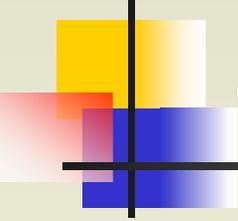
2001 n=1989 2002 n=2100



# Percent Multiple Resistance *E. coli* 2001 - 2002

■ 2001 n=2116 ■ 2002 n=4690



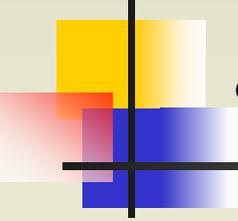


# *Enterococci*

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- ★ Started in 2000
  - ★ 2001 aggregates noticed
- ★ PCR started in 2002 for speciation
- ★ 2002 media study conducted
  - ★ Serotype recovery affected by temperature
- ★ Data is being analyzed

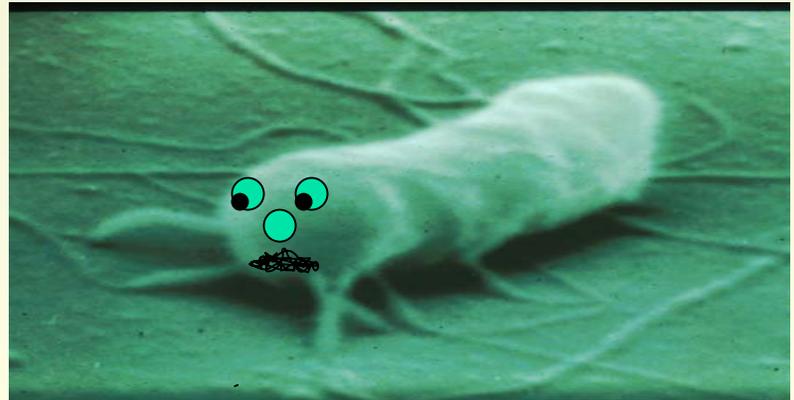
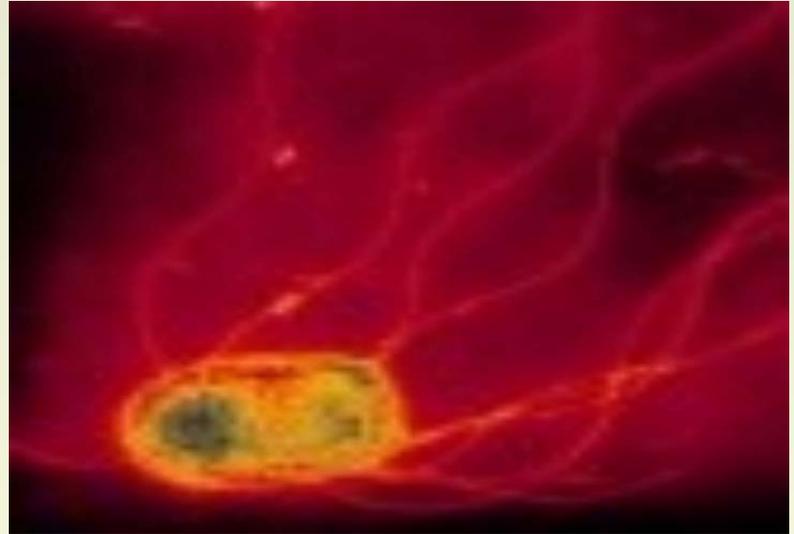




# *Salmonella*

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- ★ Over 30,000 isolates tested since 1997
- ★ Serotypes
  - ★ Vary over time
  - ★ Vary by source

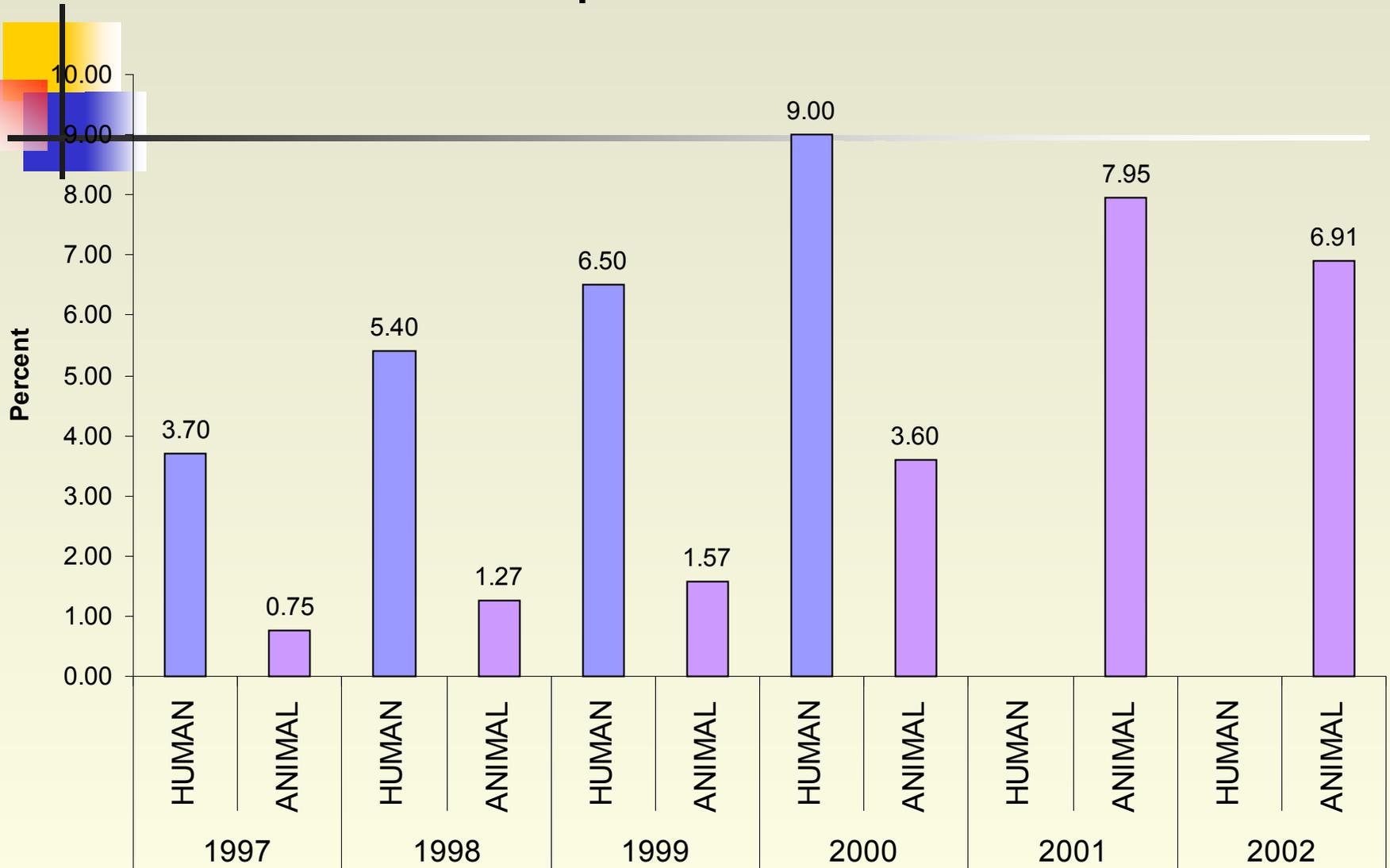


# Top 10 Serotypes by Rank 1997-2002\*

RANK	SEROTYPE	Total (1997-2002*)	TOTAL % (97-02)*	CUMULATIVE %
1	S. heidelberg	3117	9.07	9.07
2	S. kentucky	2951	8.58	17.65
3	S. typhimurium var Co	2812	8.18	8.18
4	S. typhimurium	2690	7.82	16.00
5	S. montevideo	2062	6.00	39.65
6	S. derby	1581	4.60	44.25
7	S. a natum	1407	4.09	48.35
8	S. newport	1387	4.03	52.38
9	S. agona	1304	3.79	47.11
10	S. hadar	934	2.72	58.89

\*Preliminary 2002 data

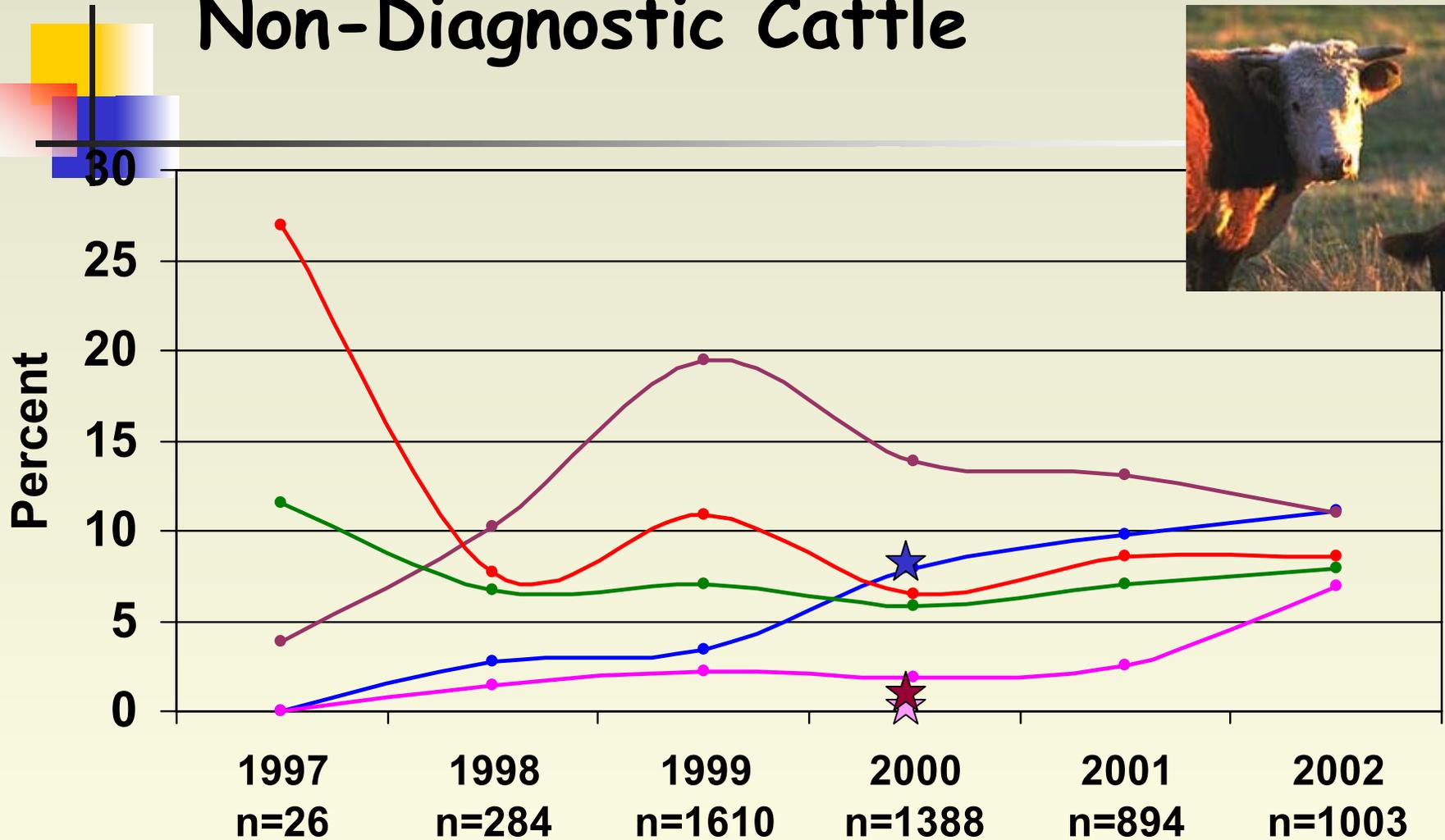
# S.newport -- 1997-2002\*



\*Preliminary 2002 animal data

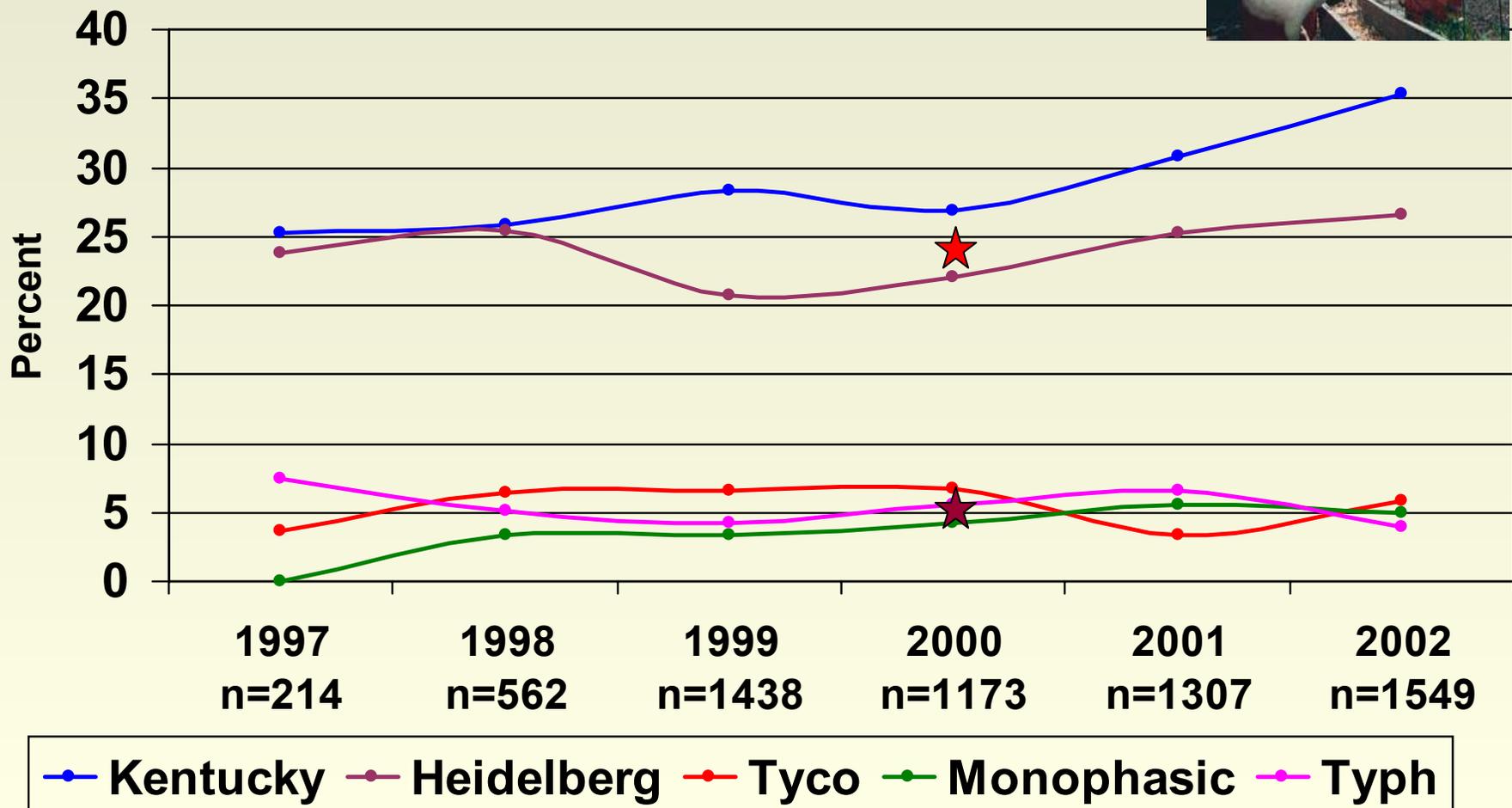
Human data not available for 2001 or 2002

# Salmonella Serotypes for 2002 Non-Diagnostic Cattle

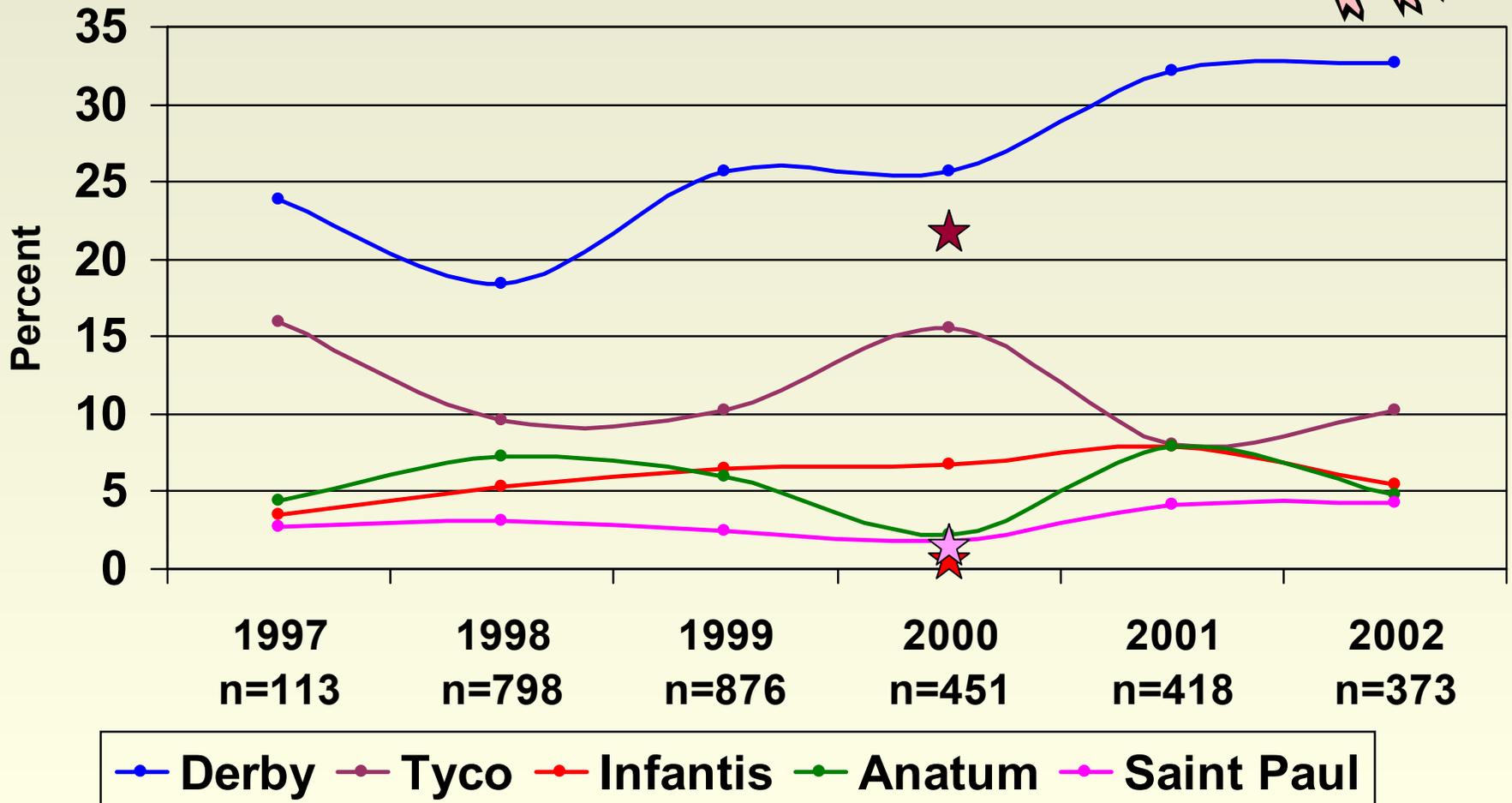


● Newport ● Montevideo ● Anatum ● Muenster ● Agona

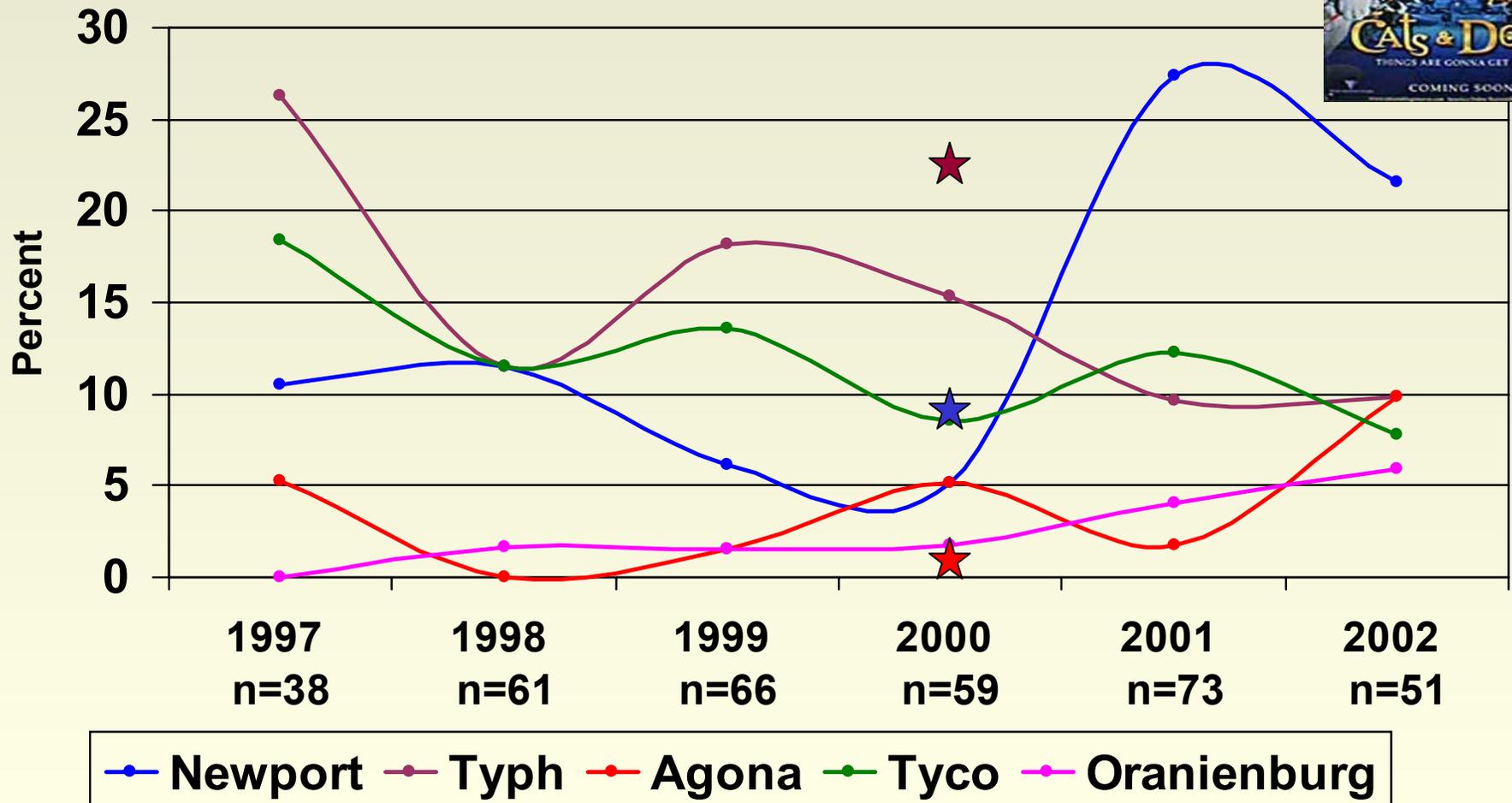
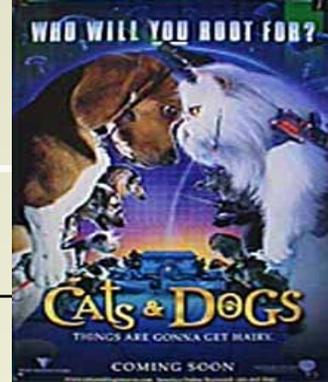
# Salmonella Serotypes for 2002 Non-Diagnostic Chicken



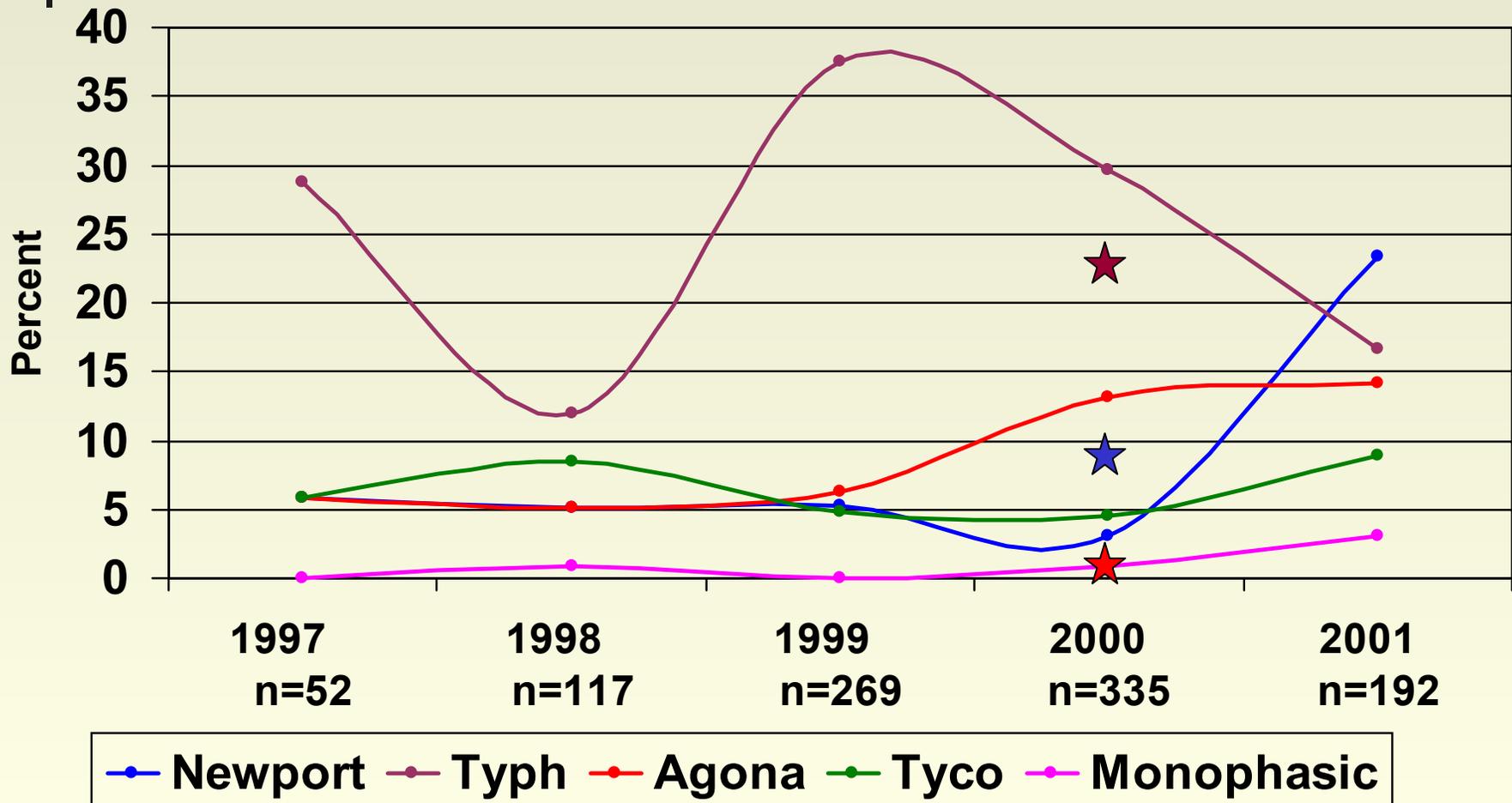
# Salmonella Serotypes for 2002 Non-Diagnostic Swine



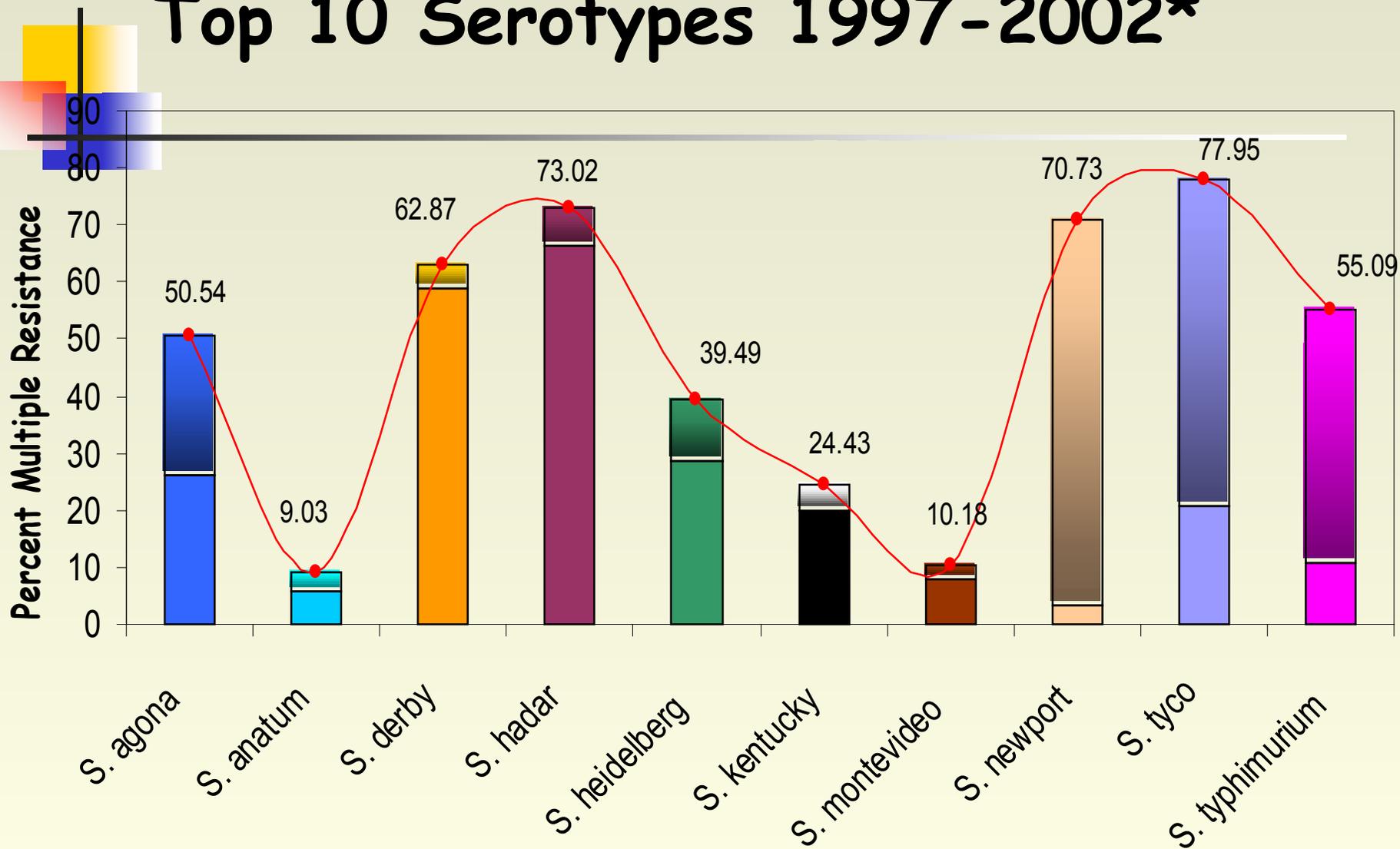
# Salmonella Serotypes for 2002 Diagnostic Dog



# Salmonella Serotypes for 2002 Diagnostic Horse

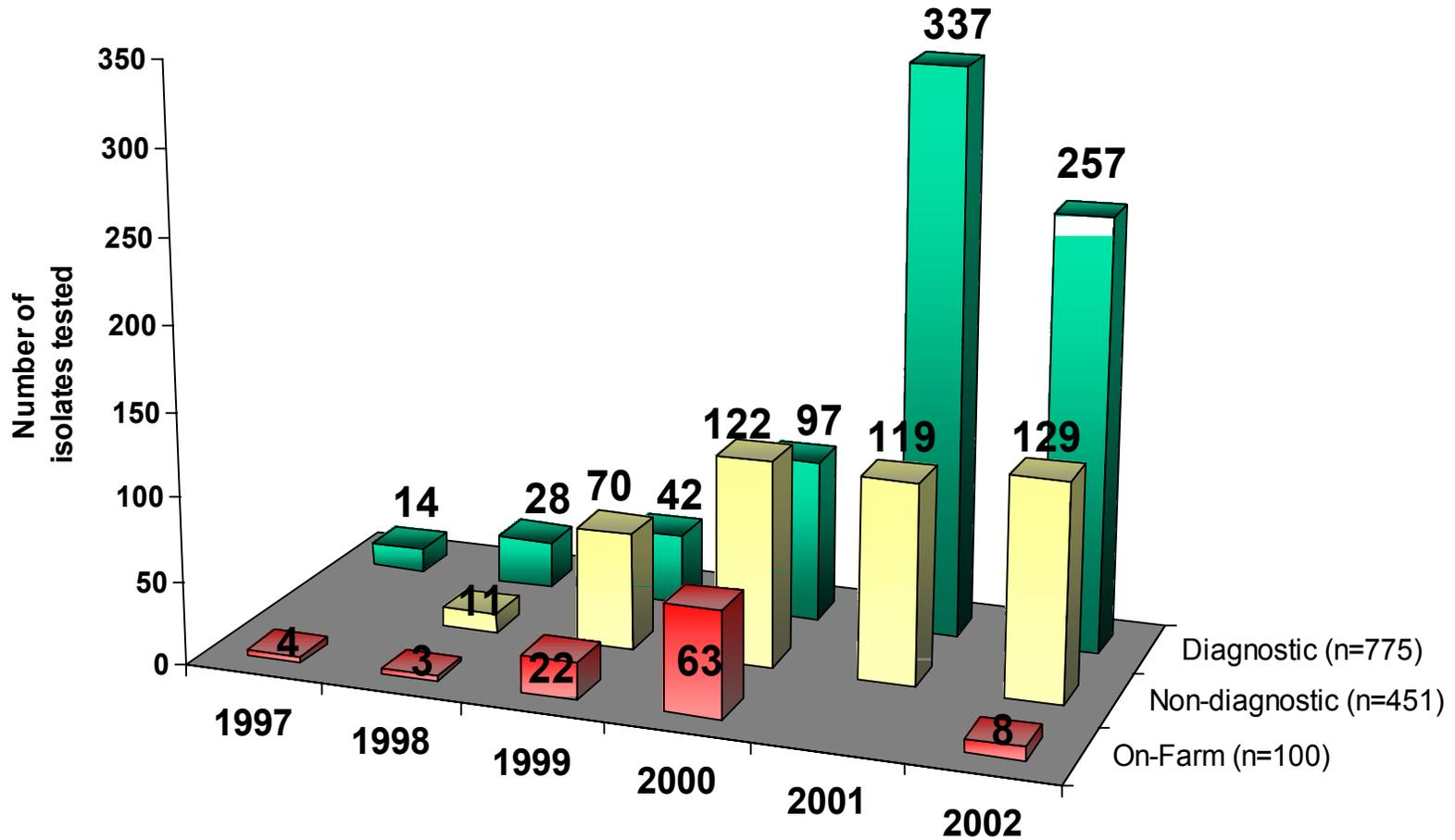


# Multiple Resistance Among Top 10 Serotypes 1997-2002\*



\*Preliminary 2002 data

# Distribution of all *S. Newport* isolates by clinical status: 1997-2002\*

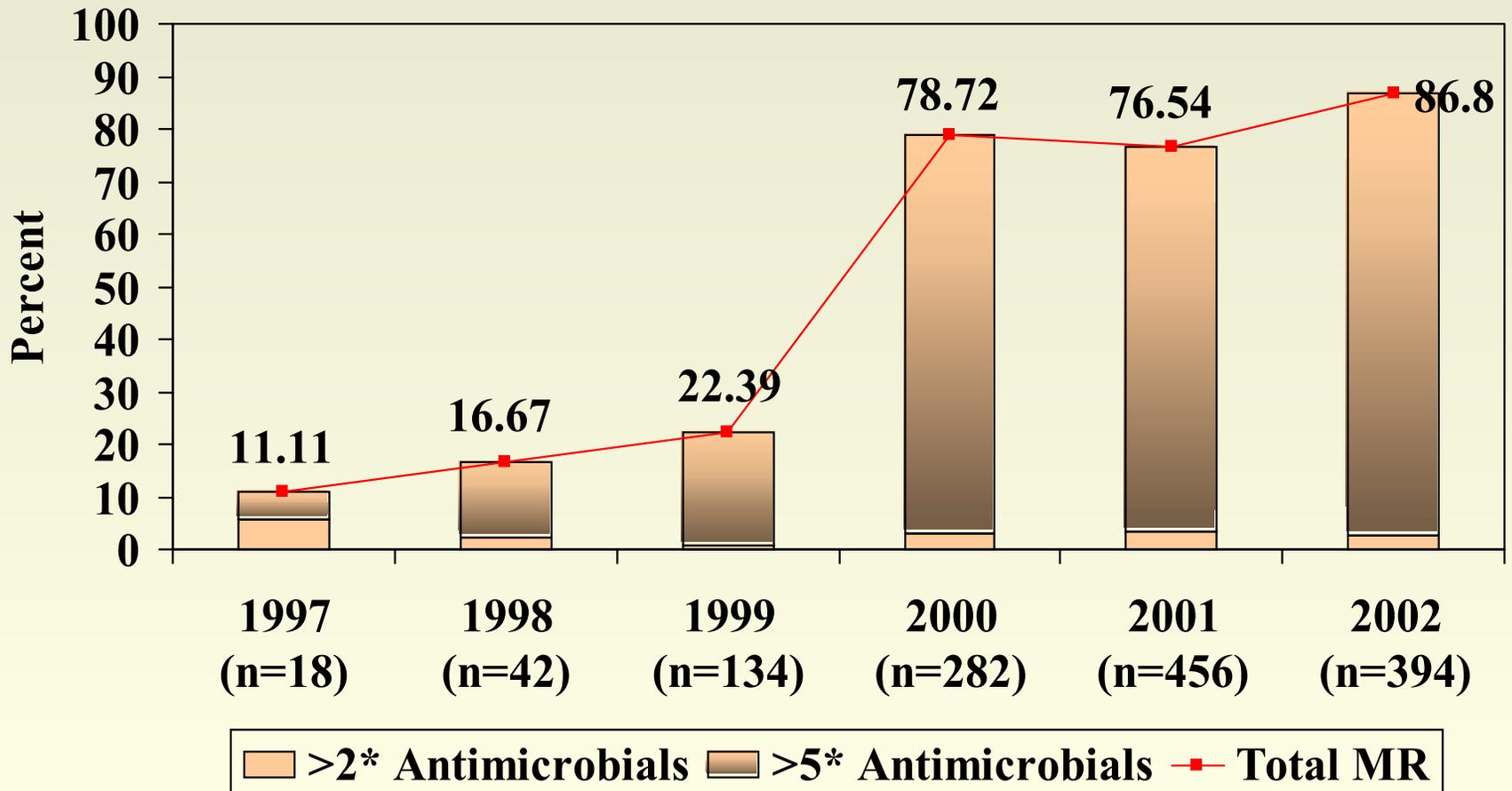


	1997	1998	1999	2000	2001	2002
Total No. of Newports	18	42	134	282	456	394
Total No. of Salmonella	2391	3318	8508	7834	5739	5999
% Newports for year	0.75	1.26	1.57	3.6	7.9	6.6

\*Preliminary 2002 Data

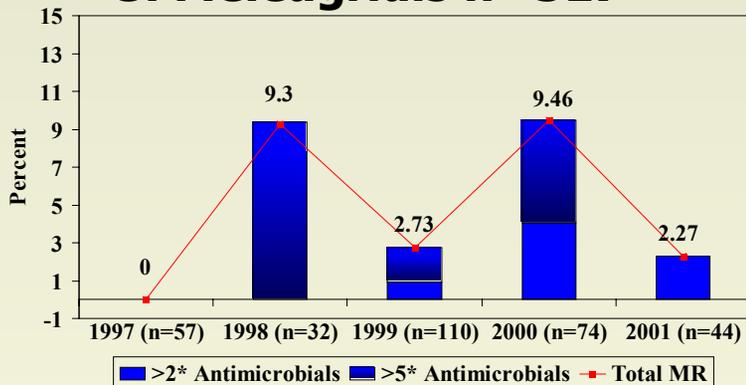
# Percent Multiple Resistance - *S. Newport*

Total number of *S. Newport* tested n=1326

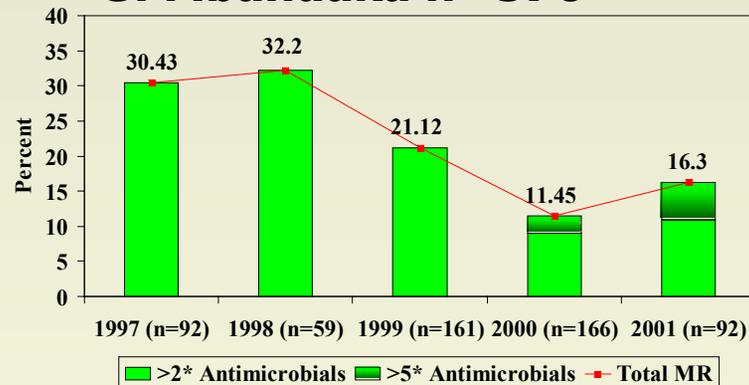


# MR Variations

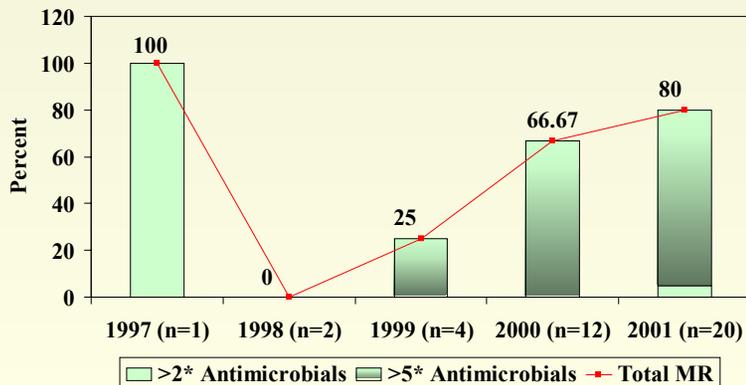
## *S. Meleagridis* n=317



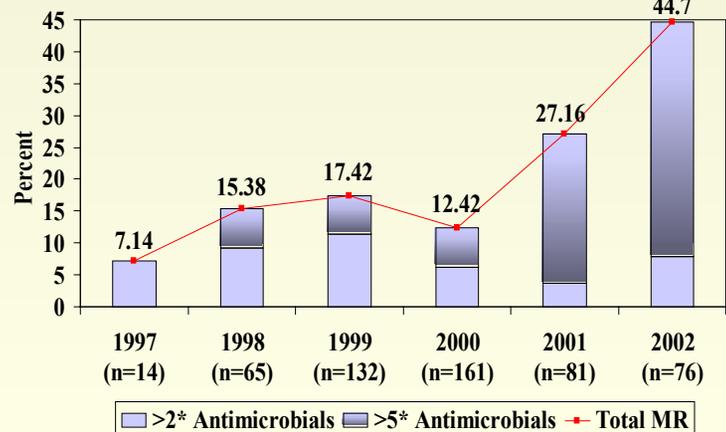
## *S. Mbandaka* n=570



## *S. Bardo* n=39

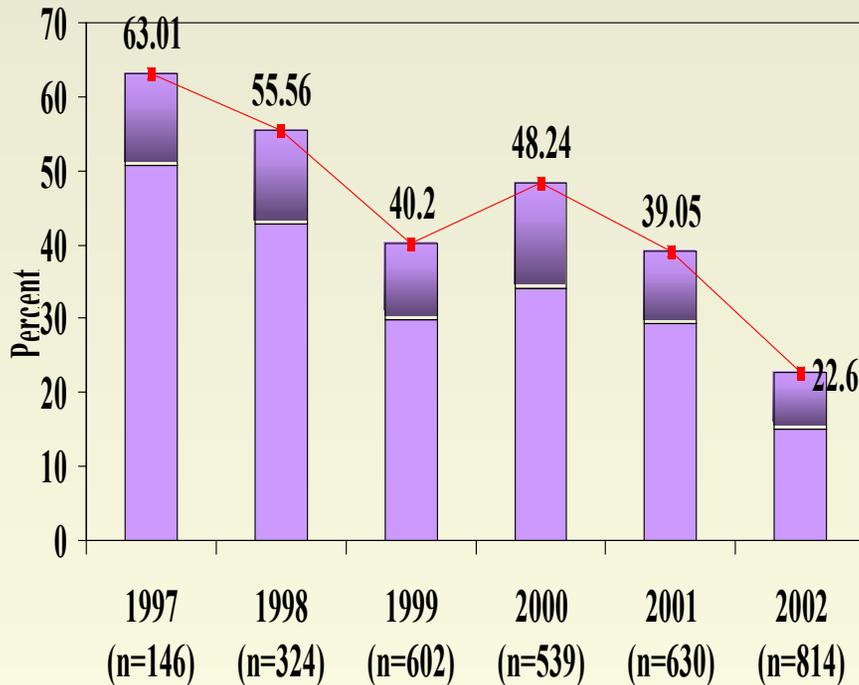


## *S. Reading* n=529



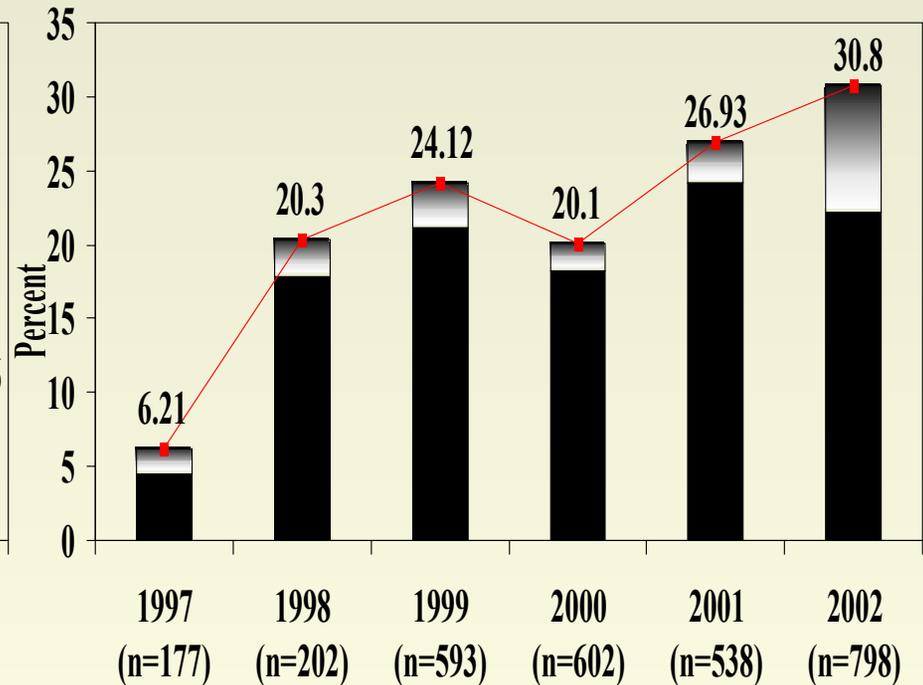
# MR Chicken Isolates

***S. Heidelberg* n=3055**

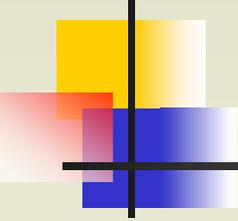


>2\* Antimicrobials
  >5\* Antimicrobials
  Total MR

***S. Kentucky* n=2910**



>2\* Antimicrobials
  >5\* Antimicrobials
  Total MR

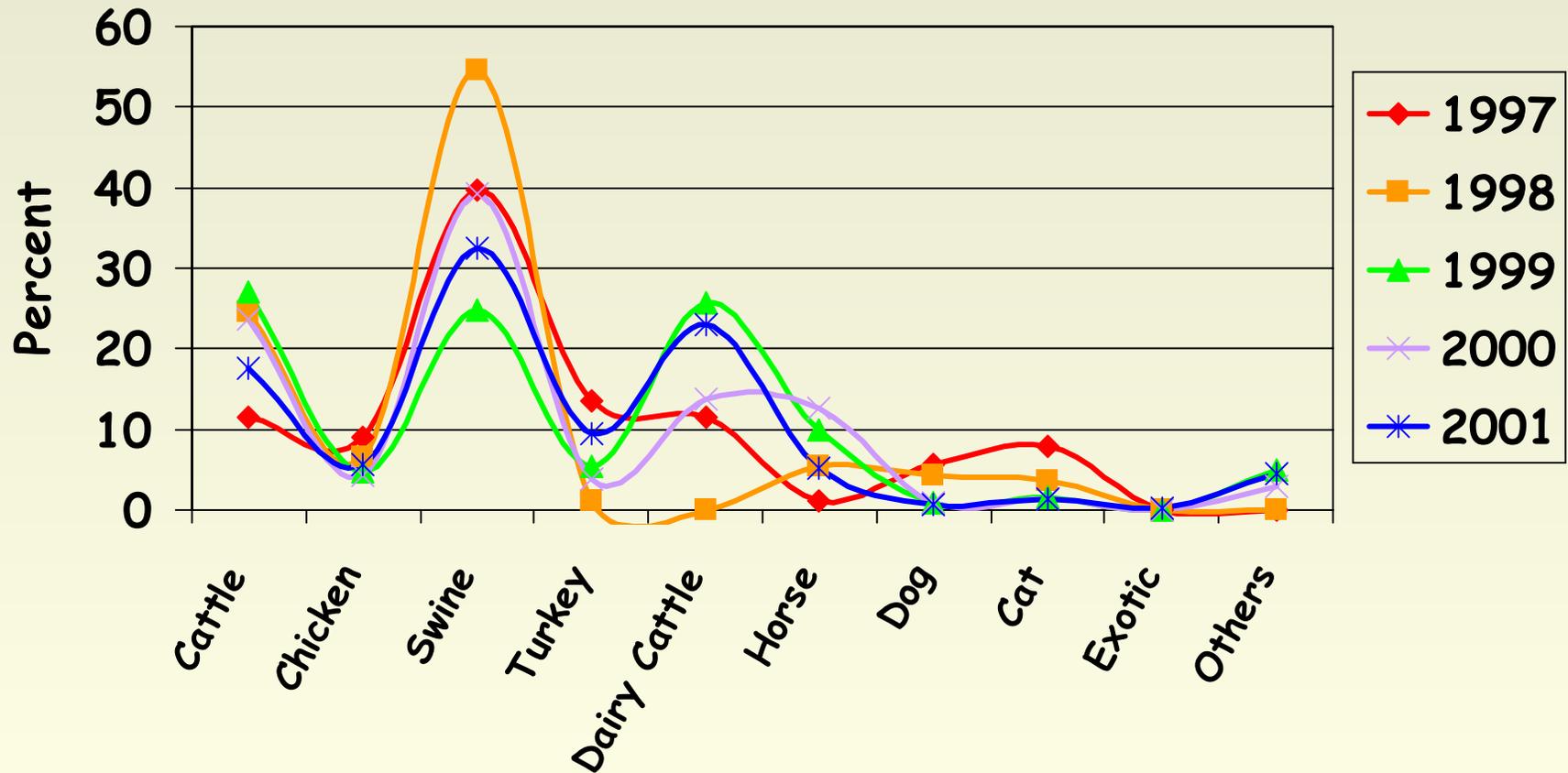


# DT104 Perspective

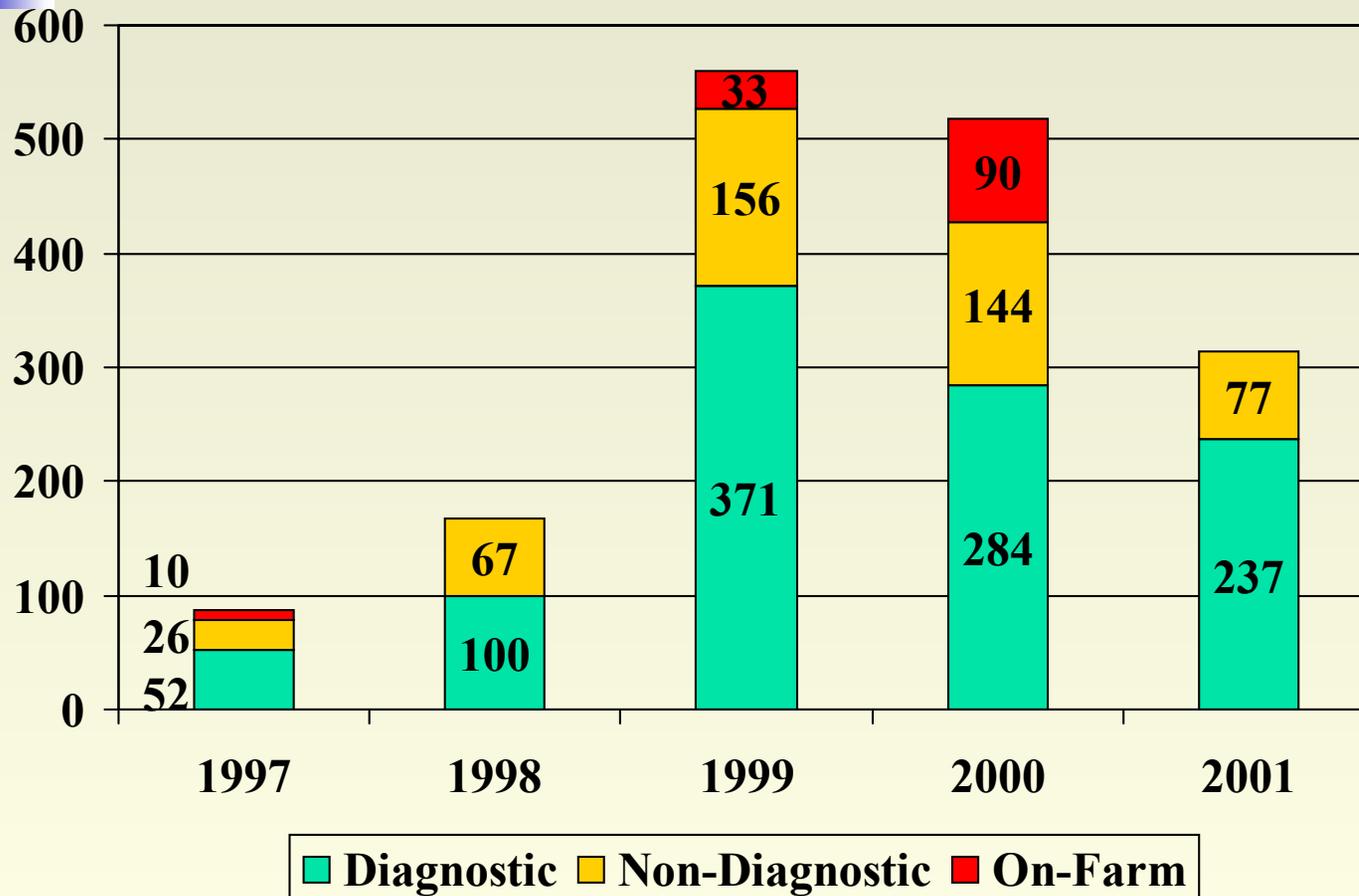
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	1997	1998	1999	2000	2001	Total
Total No. Tested	<b>2391</b>	<b>3318</b>	<b>8508</b>	<b>7834</b>	<b>5739</b>	<b>27790</b>
Tot. Typh/co	<b>328</b>	<b>557</b>	<b>1562</b>	<b>1308</b>	<b>933</b>	<b>4688</b>
% of Total	<b>13.7</b>	<b>16.8</b>	<b>18.4</b>	<b>16.7</b>	<b>16.4</b>	<b>16.9</b>

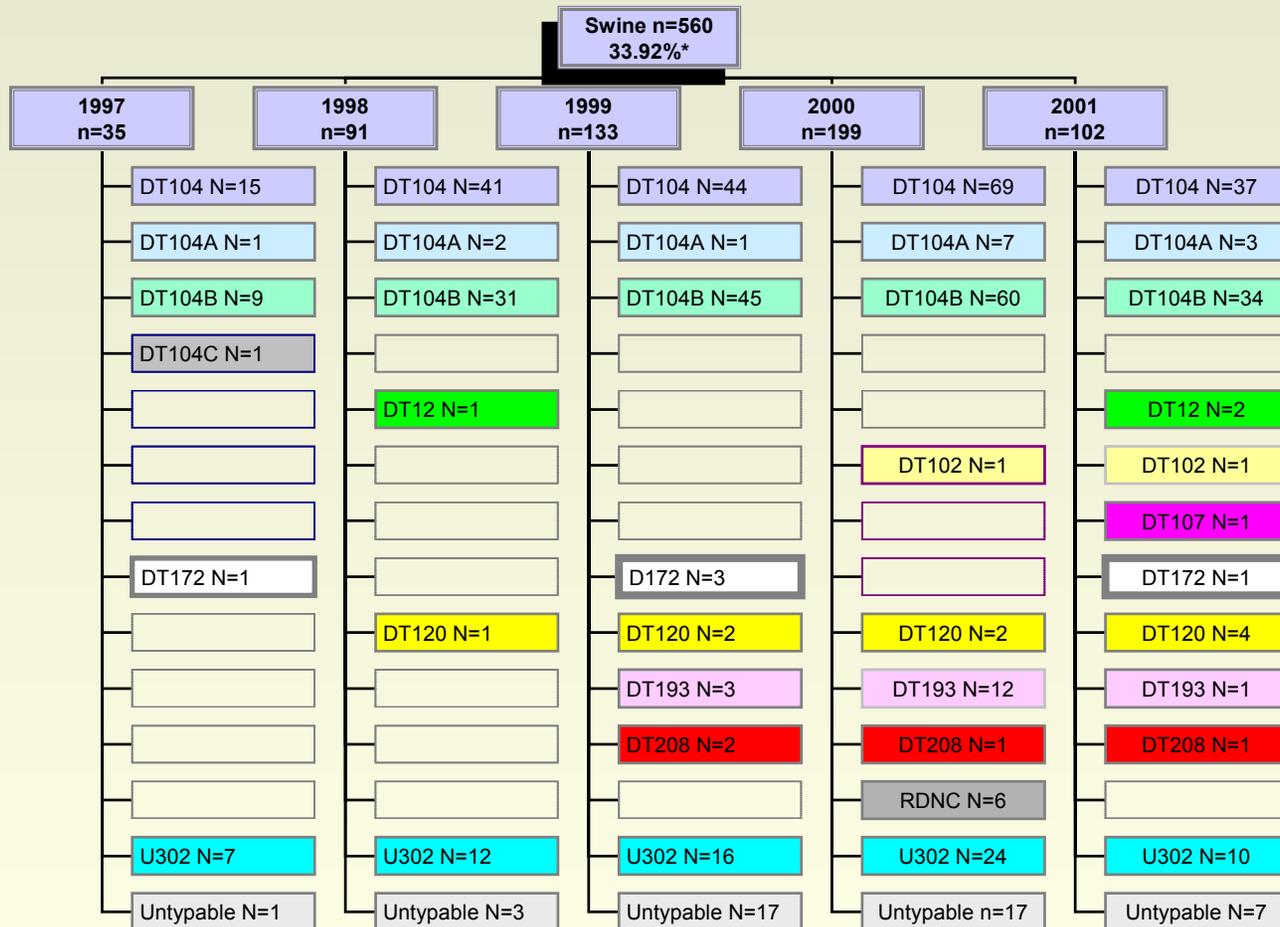
# % Typhimurium by Year and Source with Penta R Pattern



# Typhimurium by Year and Source with Penta R Pattern



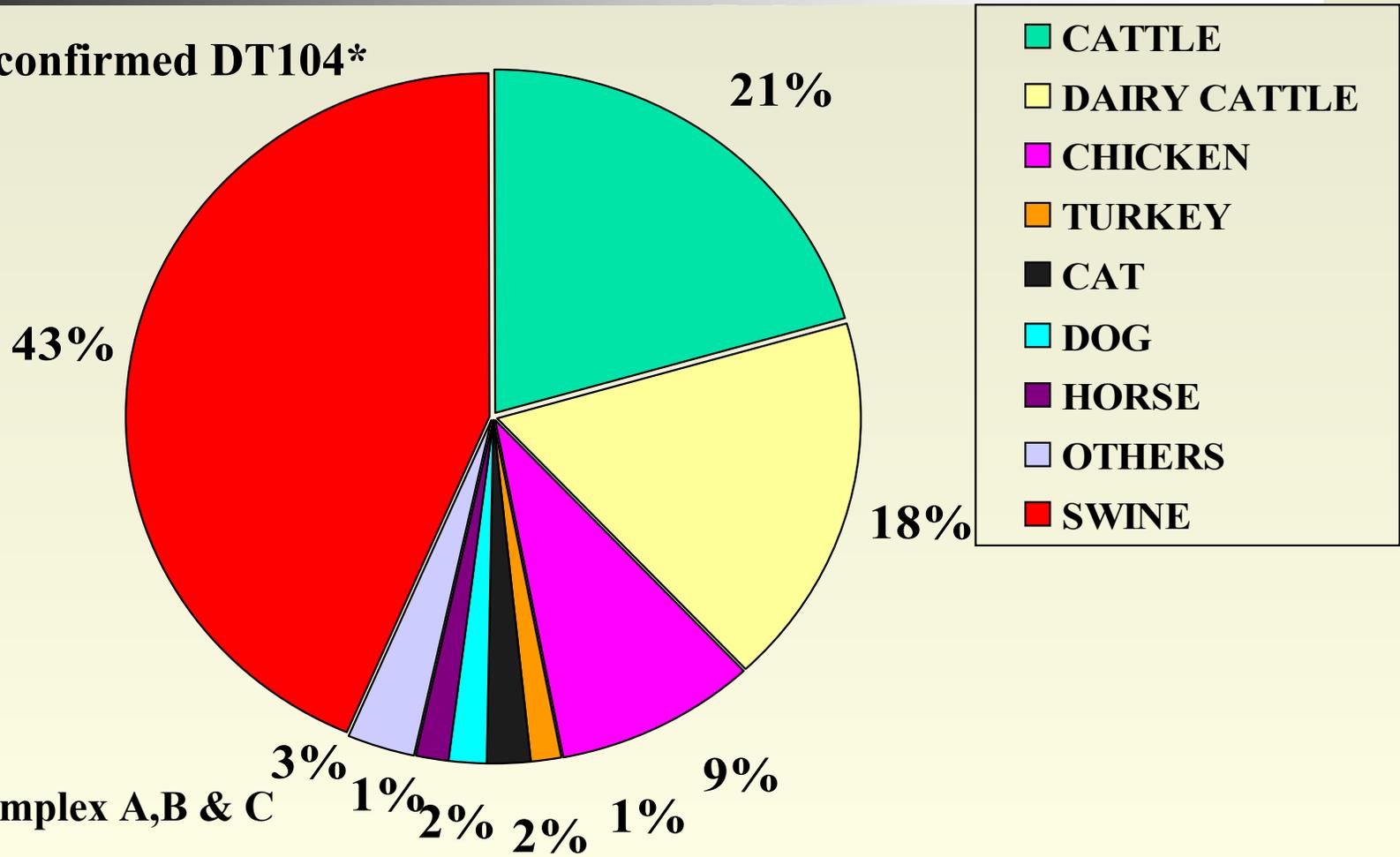
# Phage Types - Swine 1997-2001



\*% of total DT104 suspects submitted for phage typing

# Total Confirmed DT104\* by Source 1997-2002\*\*

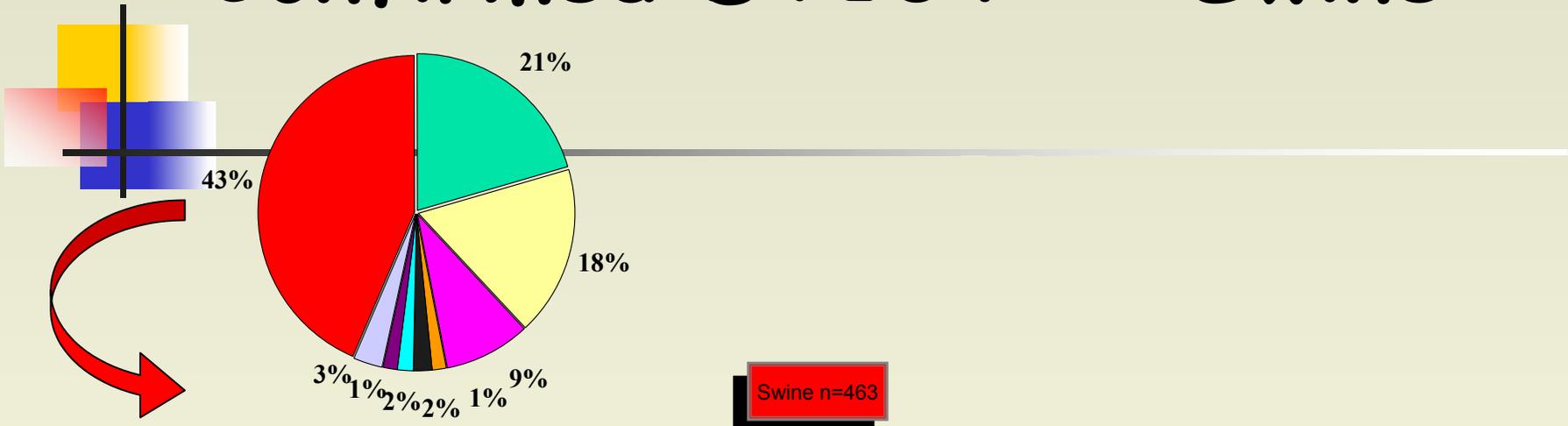
Total = 1063 confirmed DT104\*



\*DT104 + complex A,B & C

\*\*Preliminary data

# Confirmed DT104\* - Swine



Swine n=463

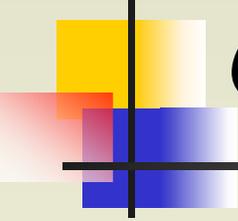
Year	Total n	Diagnostic n	Non Diagnostic n	On Farm n
1997	26	16	10	0
1998	74	34	40	0
1999	90	41	33	16
2000	136	39	25	72
2001	74	59	15	0
2002	63	52	11	0

\*DT104 + complex A,B & C

\*\*Preliminary data

**Totals**

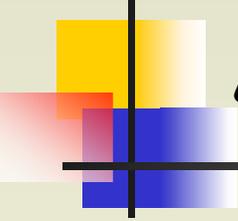
**Diagnostic= 246    Non Diagnostic= 134    On-Farm=83**



# Comments

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- ★ Culture conditions are critical
  - ★ Aggregation
  - ★ Temperature
  - ★ Use of antimicrobials
- ★ Analysis must be by species/serotype
  - ★ Many serotypes found in the same environment
- ★ Why do they come and go over time?
- ★ Why are some serotypes more likely to acquire multiple resistance?
  - ★ What is the next important serotype??????
- ★ Starting the animal arm of PulseNet

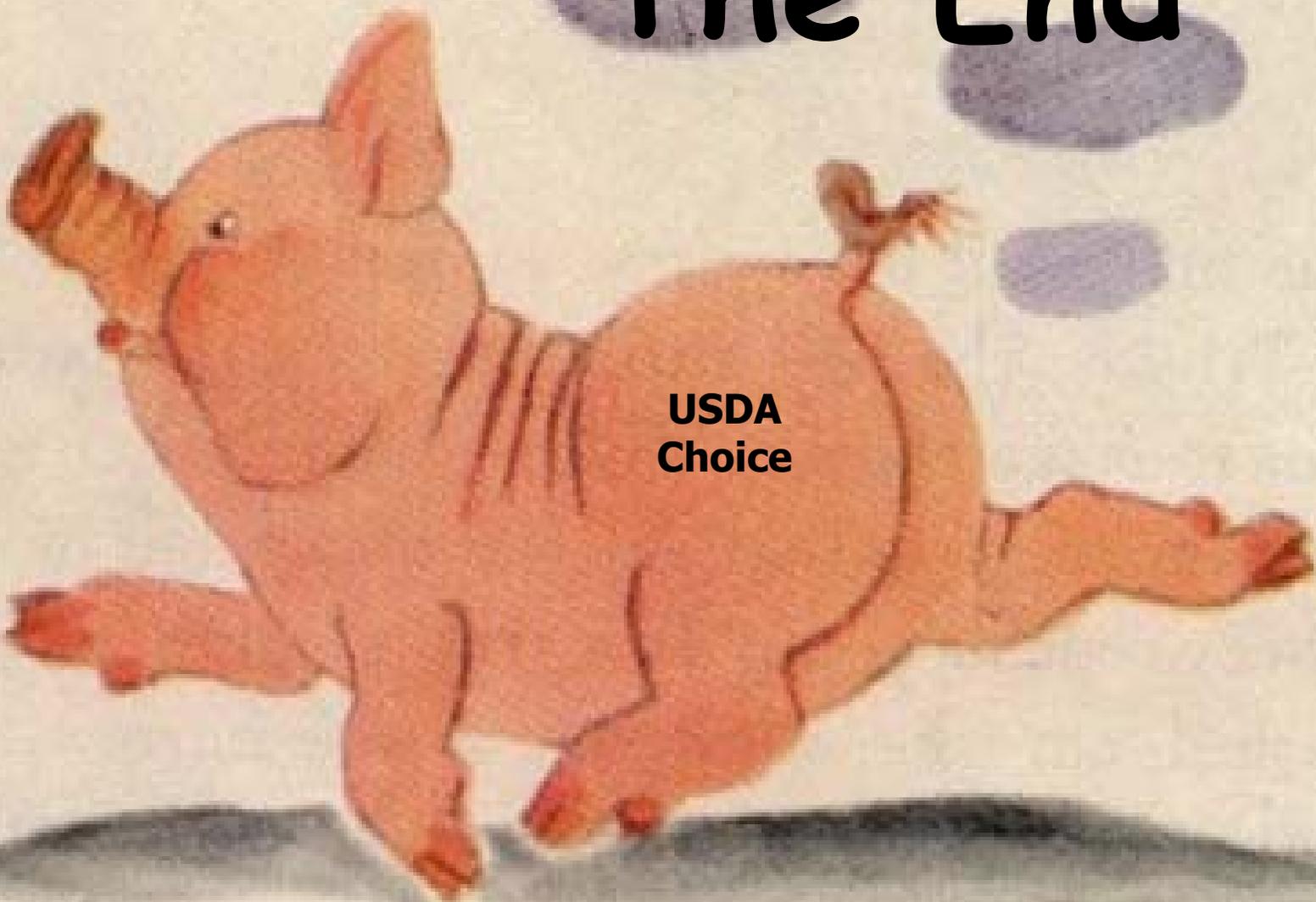


# All Things Are Possible!!

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# The End

A cartoon illustration of a pink pig running towards the left. The pig has a friendly expression, with its mouth slightly open and eyes looking forward. It has a curly tail and is shown in a dynamic, running pose. The pig is the central focus of the image, with the text 'The End' above it and 'USDA Choice' on its side.

**USDA  
Choice**

[www.arru.saa.ars.usda.gov](http://www.arru.saa.ars.usda.gov)